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METHOD OF REDUCING PHOSPHATE ORE LOSSES IN A DESLIMING PROCESS

The invention relates to the use of dispersants to reduce phosphate ore losses during desliming of a phosphate ore feed slurry containing thick slimes.

In the accompanying drawings:

Fig. 1 is a general schematic overview flowchart depicting a typical phosphate ore processing step;

Fig. 2 is an overview flowchart showing typical phosphate ore feed preparation steps; and

Fig. 3 is a graphic illustration showing no adverse affect of the reagent used in the present invention on the clay settling.

Referring now to the drawings, FIG. 1 shows a flowchart of a typical phosphate ore processing step. The method of the present invention is performed during the phosphate ore desliming step, as shown in Fig. 2.

It has been discovered that the addition of surfactants and/or organic polymers to the phosphate ore feed slurry during desliming reduces the amount of fine phosphate ore particles lost to the waste clay streams, hence improving the recovery of fine phosphate particles.

Surfactants useful in the present invention are water soluble/dispersable surface active agents, the preferred being

anionic. Surfactants suitable for use in enhancing the settling of fine phosphate ore particles from thick slime slurries preferably include those selected from, but not limited to, the group consisting of ammonium salts, lithium salts, sodium salts, and potassium salts of C_6-C_{16} alkyl-X, alkylene-X, aryl-X, alkyl aryl-X, naphthalene-X, and combinations thereof, wherein X is one of mono-sulfonic acids, poly-sulfonic acids, mono-sulfuric acids, poly-sulfuric acids, mono-phosphoric acids, poly-phosphoric acids, mono-phosphonic acids, poly-phosphonic acids, mono-carboxylic acids, poly-carboxylic acids, and combinations thereof.

Organic polymers useful in the present invention are preferably those selected from, but not limited to, the group consisting of synthetic polymers, semisynthetic polymers, natural polymers and combinations thereof.

The polymers may be selected from the group consisting of formaldehyde products, cellulose products, gelatin products, starch products, acrylamides, acrylates, and their related products.

The present invention therefore provides for a method of reducing phosphate ore losses in a desliming process. A phosphate ore preparation slurry is directed through various transport means to a desliming unit. There are many types of desliming units such as large tanks, settling tanks, sand traps, hydrocyclones, classifiers, thickeners, ground containment areas, among others.

To the slurry is added either a sufficient amount of a surfactant/surfactants, a sufficient amount of an organic polymer/polymers and/or a sufficient amount of a combination of surfactants and organic polymers. The surfactants and/or polymers are mixed with the slurry so as to reduce the viscosity of the slurry. The fine phosphate ore particles thereby settle along with the coarser fraction and are then collected and routed or directed through a beneficiation process for recovering the phosphate ore product. Phosphate ore losses to the waste clay stream are reduced using the present invention method without adversely effecting the settling rate of slimes in clay ponds as shown in the examples illustrated in Fig. 3. Fig. 3 shows the settling rates of the clay slurry at various settling times under conditions where no reagent is added, 6 ppm of reagent is added, 30 ppm of clay flocculent which is typically used to enhance the settling of clay is added, and 6 ppm of reagent is added together with 30 ppm of clay flocculent. The settling rates of the clay in the presence of 6 ppm of reagent are the same without any addition of reagent; and the settling rates of the clay in the presence of 30 ppm of clay flocculent are not effected by the addition of the 6 ppm of reagent used in the present invention. The four curves depicted in Fig. 3 are reflective of the results of each condition tested.

EXAMPLES

The following examples serve to provide further appreciation of the invention but are not meant in any way to restrict the effective scope of the invention.

EXAMPLE I

The invention was tested with a Central Florida phosphate ore. Phosphate matrix was pumped from the mine at about 40-51% solids content to the ore preparation facility. This ore preparation facility consists of a receiving tank, distributors, trommels, a settling-desliming tank, and a sand trap. The matrix was then pumped from the receiving tank to a distributor that feeds two trommels. The oversize fraction of these trommels is rejected as mud balls, whereas the undersize is discharged into the settling-desliming tank. The underflow of the settling-desliming tank is pumped to the beneficiation plant, and the overflow containing heavy clays and fine phosphate particles is fed to the sand trap. The fine phosphate particles that are settled in the sand trap return to the settling-desliming tank, whereas the overflow of the sand trap is pumped to the clay ponds as a waste stream. The phosphate ore content of the overflow of the sand trap constitutes the phosphate feed losses. In the absence of this invention, ore feed losses are heavy due to the high viscosity of the clayish slurry in both the settling-desliming tank and the sand trap.

The tests were carried out on a day on/ day off fashion to compare the effect of this invention on the reduction of feed losses. The invention was added or performed to the settling-desliming tank and to the feed to the sand trap without any pH adjustment. Table 1 presents a comparison of the feed losses reduction obtained in the presence of 0.075-0.185 lb/ton of matrix, the average addition being 0.136 lb/ton.

Table 1: Effect of the Inventive Method on the Reduction of Feed Losses

Test	TPH Losses	+150M TPH Losses	% Losses
No dispersant added	1050	715	100
Dispersant added	804	459	64
Reduction in Losses	246	256	36

The reduction in feed losses that can be recovered in the downstream unit operations is 256 TPH, corresponding to a 36% reduction of the phosphate feed losses. The phosphate recovery obtained in the absence and presence of the use of the inventive method was 80%.

EXAMPLE II

In this example, the inventive method was tested in the same industrial facility. The inventive method was applied to the receiving tank and to the settling-desliming tank where the dispersants were added at a rate of 0.073-0.110 lb/ton of matrix. As in the case of previous example, no pH adjustment was required

for the matrix. Table 2 presents a comparison of the phosphate feed losses reduction in TPH, BPL, BPL-Tons and percentages.

Table 2: Effect of the Inventive Method on the Reduction of Feed Losses

			Losses			
Test	TPH	+150M TPH	%	BPL %	BPL-Tons	%
No dispersant added	723	422	100	6.75	28.5	100
Dispersant added	540	292	69	4.71	13.8	48
Reduction in Losses	183	130	31	2.04	14.7	52

This test shows a reduction in feed losses of 130 TPH or 31% of the tonnage lost. The BPL content of the sand trap overflow (feed losses in the waste stream) is reduced from 6.75% to 4.71%. This corresponds to a recovery of 14.7 BPL-Ton or a reduction of 52% of the phosphate losses. During this test, there was no noticeable difference in the result of the phosphate flotation, which confirms that there is no adverse effect to implementing this inventive process on a phosphate flotation circuit.

It should be understood that the preceding is merely a detailed description of one or more embodiments of this invention and that numerous changes to the disclosed embodiments can be made in accordance with the disclosure herein without departing from the spirit and scope of the invention. The preceding description, therefore, is not meant to limit the scope of the invention. Rather, the scope of the invention is to be determined only by the appended claims and their equivalents.

Now that the invention has been described,